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## A PLEA FOR THE STUDY OF LIMNOBIOLOGY.

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By HENRY B. WARD.

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Historically at least the development of microscopical work is inseparably connected with the study of fresh-water life. The early students with the microscope ransacked ponds and ditches for their material and the works of these pioneers are filled with observations on the organisms of this character. Such names as Leuwenhoek, Swammerdam, Trembly, O. F. Müller, and a whole host of others almost equally well known, recall sources of information on the fresh-water fauna which are of permanent value today. The appearance in 1838 of Ehrenberg's famous volume "The Infusion Animalcules as Complete Organisms" marks in our own times a period of advance coincident with noteworthy improvements in the instrument of research. Since then many investigators of repute and I think it may be confidently asserted the majority of private workers also have found in the fresh-water life of their region the most accessible and most fruitful field of study.

During the earlier years of its history this Society devoted its attention largely to biologic problems, and the majority of these touched in some way upon the life of our inland waters. Thus the work of Vorce on the organisms of Lake Erie, of H. L. Smith and Cox on diatoms and the long series of contributions by Kellicott on the fresh-water fauna marked a tendency which was generally manifested in the public and private work of the Society. Somewhat later this movement declined and the published Proceedings show that the majority of the papers were devoted to technic and to the construction of apparatus, much of it manifesting a thoroughly transient character. There were to be sure occasional papers of the earlier type but even Kellicott, whose contributions are wanting in but one of the first thirteen volumes of the Society Proceedings, failed for five

years to add anything in this line of work. There has come, however, of late a decided increase in contributions which may be classed in large part at least in this field since they were worked out on fresh-water vertebrates. The microscopical structure of these forms has been studied with great vigor by an active branch of our membership, and this new movement of Gage and his pupils towards the development of a comparative histology added to the work of the Society an element of great interest and permanent value.

It cannot be doubted, I believe, that mere technic and details of apparatus and its construction do not furnish a sufficient *raison d'être* for an organization having a widely distributed membership and seeking to interest a varied class of workers. The topic is secondary, not primary; methods vary greatly in different fields; they often need modification even for different objects of the same character, and must be worked out in large measure by each student to suit his particular problem. The results are thus devoid of general interest or suited rather to the pages of a journal devoted specifically to technic, in which moreover they may be expected to appear with less delay than is incident upon the publication of a large annual volume. Such journals, a few, exist in our own country, and to them I believe this Society should accord its hearty support and at the same time relegate to them for publication papers of this character. It certainly is not wise for us to compete with them in a field already well occupied, especially when our members are getting more of this work and more promptly than we can hope to give it to them.

Some definite lines of work are, however, evidently necessary to hold our membership together, to keep up interest and arouse activity and more than all to attract new members sufficient to meet the annual decline of membership from natural causes and to keep the Society in a healthy condition by the infusion of new blood. Such lines of work must necessarily have certain characteristics if they are to meet the conditions just mentioned. They must be definite, they must attract a considerable number of workers and yet be sufficiently circumscribed to unify the entire

membership of the organization. They must moreover possess a permanent value if the work of the organization is to command the attention and respect of the scientific world. It would seem further to be highly advantageous were such aims to be in fields not already occupied by other organizations and other influences. From the past character of this Society it is also apparent that these ends should appeal both to teachers and to private workers, to specialists and to dilettanti, and finally they should have in the microscope the main tool by which their results are to be gained. In them, then, the emphasis is laid not upon means except as they conduce to ends, not upon methods except as they bring results.

It is not difficult from the recent history of the Society to cite a striking concrete illustration of these general principles just elucidated. The work of Gage and his pupils on comparative histology has furnished a decidedly original and permanently valuable portion of the contributions from members during recent years. Other less clearly marked or more strongly individualistic tendencies might be mentioned but the one will suffice.

It is my purpose to call attention here to a field of work in which as already noted this Society was active in its earlier history, and which to a peculiar extent meets the conditions for successful prosecution which have just been discussed. The study of fresh-water life formed the original field of microscopical investigation; in it were prepared as already noted those masterpieces of Leuwenhoek, Swammerdam, Rösel von Rosenhof and a host of other early students with the microscope who contributed so much to the advancement of biological science. In it has been done the major part of the study attempted by private workers with the microscope in all lands. It appeals to the college teacher as well, and aside from the few who are favorably located so that they may have recourse to the shore regularly or in the interval of a vacation, it is the great and only field of work for the inland naturalist. As yet comparatively unoccupied and thus in strong contrast with conditions

which prevail in the field of marine biology, it is broad enough in its extent to draw together the most varied workers. The part of the botanist, the zoologist, and even the bacteriologist, in its development is sufficiently clear to need no demonstration, and the solution of its problems will certainly demand the cooperation of the physicist and the chemist in working out the conditions of existence and the processes of change, while its importance from another point of view to the sanitary engineer and to those engaged in solving the practical problems involved in the water supply of the more closely settled portions of our country cannot be over estimated. Although thus extensive in its complete aspect, this topic is yet unusually flexible in the ease with which it may be subdivided. A student of nature may attack any point in this broad field with assurance that careful work, however limited, will meet with adequate returns and if not misdirected contribute proportionally towards the solution of the greater problems in the field. The field is furthermore one which with the development of scientific work, both private and public, throughout the great continental area of our country, will demand the attention and interest of a constantly increasing number of workers. It may profitably even today be forced upon the attention of many who bemoan the fact that their distance from the sea precludes scientific work, for it offers its problems everywhere that a pond may be found or a temporary pool is formed by the spring rains. While it gives an opportunity for all kinds of work, taxonomic, anatomic, embryologic or physiologic, once embarked in the study the investigator will be led sooner or later into the study of conditions of existence and will find in ecology problems presented with a clearness and singleness that cannot be matched elsewhere. In some such a "unit of environment" as one of our members has called the lake, is offered greater simplicity and a more definitely limited problem than is presented in most lines of biologic study. Such a circumscribed region may be held under daily observation and the records of this study will demonstrate the rise and fall of species, the struggle for existence and kindred topics of biological import as they can hardly

be seen elsewhere. And all these possibilities lie near the student; instead of asking him to reach after that which for some is unattainable, this field offers an abundance of material close at hand. This again comes before the eye in its living form and impresses the investigator in its character of living working organisms so that in such work it is not difficult to see an antidote for the excessive laboratory tendency which marks the present time, at least in college biologic work.

In thus urgently calling to your attention, a prolific and attractive field of work, let me not neglect to clear myself of one probable imputation. It is not my hope or desire to impress all members in this field of study. The Society has carried on valuable and successful work in many lines and will continue to do so. Here however is room for the unoccupied, and it may be uninterested, student; it will afford him occupation and kindle his zeal. It is preeminently the field for the amateur microscopist and for the professional man who seeks in microscopical studies his pastime. One has only to scan the attractive pages of "Science Gossip" with its wealth of biological observations to see what a hold such studies have on our cousins across the sea. Who can doubt that such work constantly attracts new students to this field of study? Through our continental area there are far more varied conditions and greater opportunities than are offered the English student of fresh-water life and these questions are almost untouched as yet. In considering then the importance, the general interest and variety of such studies and their fruitfulness, no less than their intimate connection with the development of microscopical science and of this organization, is it not just to ask that the Society appoint a special committee or group of workers who shall consider the question of furthering such work and shall report to the Society the best methods for encouraging and directing it in our own country?\*

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\* The recommendations of the Executive Committee and the action of the Society on this matter may be found in the Minutes at the close of this volume.

As an index of what this Society has done in the past twenty-one years of its existence the following synopsis and bibliography is presented. Papers have been entered under their main subjects only and none included which do not in first instance treat of some topic in fresh-water biology. Those papers which deal merely with technic are not included though many of them are useful and a few of immediate importance in their bearing on fresh-water biology. Bacteriological contributions are also omitted. Out of a total of 419 separate papers in the twenty volumes of Proceedings and Transactions of the American Microscopical Society, 77 or about twenty per cent. are included in this list.

GENERAL—

- Faunistic: Mills, 83; Vorce, 82, 83.
- Methods of Work: Conser, 96; Ward, 96a.
- Ecologic: Ward, 96.
- Summary Review: Ward, 99.

ECONOMIC—

- Water Supply: Hyatt, 83; Krauss, 97; Thornbury, 97; Veeder, 97.
- Sewage: Bennett, 85.

BOTANIC—

- General: Mills, 83; Vorce, 82, 83.
- Desmids: Wolle, 84.
- Diatoms: Cox, 86, 91, 91a; Durkee, 85; Hyatt, 83; H. L. Smith, 83, 87, 88; Vorce, 86.
- Fungi: Bennett, 85.
- Chara: Rowlee, 96.
- Victoria Regia: Seaman, 92.

ZOOLOGIC—

- General: Mills, 83; Vorce, 82, 83.
- Protozoa: Fisher, 81; Kellicott, 84, 84a, 85, 85a, 86, 88a, 89, 89b; Perry, 91; Smith, J. C., 98, 98a, 99; Stedman, 89.
- Porifera: Mills, 83a, 85, 87; Stedman, 92.
- Plathelminthes: Kellicott, 84b; Ward, 94.

Annelida: Up de Graff, 84.

Rotatoria: Kellicott, 85a, 86a, 88, 89a, 90, 97, 98;  
Up de Graff, 84; Vorce, 88, 91a.

Bryozoa: Kellicott, 83a.

Crustacea: Fellows, 88; Kellicott, 80, 80a, 81, 83, 87,  
93; Vorce, 91.

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#### VERTEBRATA—

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Histology: Claypole, A. M., 95; Gage, S. H., 86; Gage,  
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#### PARASITES—

Kellicott, 80, 80a, 81, 83, 84b, 87, 93; Ward, 94; Wolcott, 99.

### LITERATURE.

BENNETT, A. W.

85. Fungi Found in Sewage-Effluents.  
Proc. Am. Soc. Mic., VI, 90-92.

BERRY, J. M.

98. A comparison of the Phagocytic Action of Leukocytes in  
Amphibia and Mammalia.  
Trans. Am. Mic. Soc., XIX, 98-116, 5 Pl.

BRITCHER, H. W.

99. An Occurrence of Albino Eggs of the Spotted Salamander,  
*Amblystoma punctatum* L.  
Trans. Am. Mic. Soc., XX, 69-74, 1 Pl.

CLAYPOLE, A. M.

95. The Enteron of the Cayuga Lake Lamprey.  
Proc. Am. Soc. Mic., XVI, 125-163, Pls. III-X.

CLAYPOLE, E. J.

94. The Blood of *Necturus* and *Cryptobranchus*  
Proc. Am. Soc. Mic., XV, 39-76, 6 Pls.



CONSER, H. N.

96. Cocaine in the Study of Pond-Life.  
Trans. Am. Mic. Soc., XVII, 310-311.

COX, J. D.

86. Some Diatom Hoops. The Question of their Mode of Growth (*Aulacodiscus kittoni*).  
Proc. Am. Soc. Mic., VII, 33-37.
91. Deformed Diatoms.  
Proc. Am. Soc. Mic., XII, 178-183, 1 Pl.
- 91a. The Coscinodisceae. Notes on Some Unreliable Criteria of Genera and Species.  
Proc. Am. Soc. Mic., XII, 184-204, 2 Pl.

DURKEE, R. P. H.

85. The Structure of the Diatom Valve.  
Proc. Am. Soc. Mic., VI, 105-9.

FELLOWS, C. S.

88. A Description of *Ergasilus chautauquaensis*. A new species of Copepoda, and a list of other Entomostraca found at Lake Chautauqua, in August, 1886.  
Proc. Am. Soc. Mic., IX, 246-249, 1 Pl.

FISHER, J. H.

81. Notes on the Structure, Development, and Position of an undescribed Flagellate Infusorian.  
Proc. Am. Soc. Mic., II, 44-49, 2 colored Pls.

GAGE, S. H.

86. Notes on the Epithelium Lining the Mouth of Necturus and Menopoma.  
Proc. Am. Soc. Mic., VII, 126-127.
89. The Form and Size of the Red Blood Corpuscles of the Adult and Larval Lamprey Eels of Cayuga Lake.  
Proc. Am. Soc. Mic., X, 77-83.

GAGE, S. P.

96. Comparative Morphology of the Brain of the Soft-Shelled Turtle (*Amyda mutica*) and the English Sparrow (*Passer domestica*).  
Trans. Am. Mic. Soc., XVII, 185-238.
97. The Brain of the Embryo Soft-Shelled Turtle.  
Trans. Am. Mic. Soc., XVIII, 282-286.

GREEN, I. M.

97. The Peritoneal Epithelium of some Ithaca Amphibia.  
Trans. Am. Mic. Soc., XVIII, 76-106, 5 Pls.

HOPKINS, G. S.

91. Structure of the Stomach of *Amia calva*.  
Proc. Am. Soc. Mic. XII, 165-169, 1 Pl.

HYATT, J. D.

88. Sporadic Growth of Certain Diatoms and the Relation Thereof to Impurities in the Water Supply of Cities.  
Proc. Am. Soc. Mic., IV, 197-199.

KELLCOTT, D. S.

80. On Certain Crustacea Parasitic on Fishes from the Great Lakes.  
Proc. Am. Soc. Mic., I, 3-57, 3 Pls.
- 80a. Observations on *Lerneocera cruciata*.  
Proc. Am. Soc. Mic., I, 64-68.
81. *Lerneocera tortua*, n. s.  
Proc. Am. Soc. Mic., II, 41-43, 1 Pl.
83. On Certain Crustaceous Parasites of Fresh-Water Fishes.  
Proc. Am. Soc. Mic., IV, 75-78.
- 83a. Polyzoa. Observations on Species Detected near Buffalo, N. Y.  
Proc. Am. Soc. Mic., IV, 217-229, 1 Pl.
84. On Some Infusoria Found on the Cray-Fish.  
Proc. Am. Soc. Mic., V, 105-111.
- 84a. *Cothurnia lata*, n. s.  
Proc. Am. Soc. Mic., V, 113-114.
- 84b. Notes on Two Parasites of the Cray-Fish.  
Proc. Am. Soc. Mic., V, 115-116.
85. Observations on Infusoria, with Descriptions of New Species.  
Proc. Am. Soc. Mic., VI, 110-125, 1 Pl.
- 85a. Notes: Infusoria, Rotatoria, etc.  
Proc. Am. Soc. Mic., VI, 126-130.
86. Observations on Some Fresh-Water Infusoria. With Descriptions of a Few Species Regarded as New.  
Proc. Am. Soc. Mic., VII, 38-47, 1 Pl.
- 86a. A New Floscule.  
Proc. Am. Soc. Mic., VII, 48-50, 1 Pl.
87. A Note on *Argulus catostomi*.  
Proc. Am. Soc. Mic., VIII, 144.
88. Additional Notes on Certain Species of Rotifera.  
Proc. Am. Soc. Mic., IX, 181-186.
- 88a. Some New and Rare Infusoria.  
Proc. Am. Soc. Mic., IX, 187-190.
89. The Nature of Protozoa and Lessons of these Simplest Animals.  
Proc. Am. Soc. Mic., X, 5-32.
- 89a. Partial List of Rotifera of Shiawassee River at Corunna, Michigan.  
Proc. Am. Soc. Mic., X, 84-96.
- 89b. Observations on Fresh-Water Infusoria.  
Proc. Am. Soc. Mic., X, 97-106.

90. A New Rotiferon.  
Proc. Am. Soc. Mic., XI, 32-33.
  93. A Crustaceous Parasite of the "Miller's Thumb" (Cottus).  
Proc. Am. Mic. Soc., XIV, 76-79.
  97. The Rotifera of Sandusky Bay.  
Trans. Am. Mic. Soc., XVIII, 155-164.
  98. The Rotifera of Sandusky Bay (Second Paper).  
Trans. Am. Mic. Soc., XIX, 48-54.
- KINGSBURY, B. F.
95. The Histological Structure of the Enteron of *Necturus maculatus*.  
Proc. Am. Mic. Soc., XVI, 19-64, 8 Pls.
  96. The Lateral Line System of Sense Organs in some American Amphibia, and Comparison with the Dipnoans.  
Trans. Am. Mic. Soc., XVII, 115-154, 5 Pls.
  - 96a. The Spermatheca and Methods of Fertilization in some American Newts and Salamanders.  
Trans. Am. Mic. Soc., XVII, 261-304, 4 Pls.
  99. The Regeneration of the Intestinal Epithelium in the Toad (*Bufo lentiginosus americanus*) during Transformation.  
Trans. Am. Mic. Soc., XX, 45-48.
- KRAUSS, W. C.
97. The Requisites of a Pure Water-Supply.  
Trans. Am. Mic. Soc., XVIII, 165-175.
- MILLS, H.
83. Microscopic Organisms in the Buffalo Water-Supply and in Niagara River.  
Proc. Am. Soc. Mic., IV, 165-175.
  - 83a. Fresh-Water Sponge.  
Proc. Am. Soc. Mic., IV, 209-216, 1 Pl.
  85. Thoughts on the Spongidae with Reference to the American Sponges of the Fresh-Water Group, with some Account of them in Detail.  
Proc. Am. Soc. Mic., VI, 131-147.
  87. Notes on the Fresh-Water Sponges.  
Proc. Am. Soc. Mic., VIII, 132-139.
- PERRY, S. H.
91. Rhizopods of Oakland County, Michigan.  
Proc. Am. Soc. Mic., XII, 94-96.
- ROWLEE, W. W.
96. The Chlorophyll Bodies of *Chara coronata*.  
Trans. Am. Mic. Soc., XVII, 155-156.
- SEAMAN, W. H.
92. The Victoria Regia.  
Proc. Am. Soc. Mic., XIII, 163-170.

## SMITH, H. L.

83. *Rhizosolenia gracilis*, n. sp.  
Proc. Am. Soc. Mic., IV, 177-178.
87. A Contribution to the Life History of the Diatomaceae.  
Proc. Am. Soc. Mic., VIII, 30-66, 5 Pl.
88. A Contribution to the Life History of the Diatomaceae, II.  
Proc. Am. Soc. Mic., IX, 126-167, 6 Pls.

## SMITH, J. C.

98. Notices of Some Undescribed Infusoria from the Infusorial Fauna of Louisiana.  
Trans. Am. Mic. Soc., XIX, 55-68, 1 Pl.
- 98a. The Sporular Development of the *Ameba villosa* Leidy.  
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99. Notices of Some Undescribed Infusoria from the Infusorial Fauna of Louisiana.  
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89. On the Development and a Supposed New Method of Reproduction in the Sun Animalcule—*Actinosphaerium eichhornii*.  
Proc. Am. Soc. Mic., X, 107-118, 1 Pl.
92. The Nervous System of the Fresh-Water Sponge.  
Proc. Am. Soc. Mic., XIII, 77-78.

## THORNBURY, F. J.

97. The Increasing Pollution of Our Municipal Water-Supplies.  
Trans. Am. Mic. Soc., XVIII, 182-198.

## UP DE GRAFF, T. S.

84. Descriptions of Certain Worms.  
Proc. Am. Soc. Mic., V, 117-119.

## VEEDER, M. A.

97. Public Water-Supply for Small Towns.  
Trans. Am. Mic. Soc., XVIII, 176-181.

## VORCE, C. M.

82. Forms Observed in Water of Lake Erie.  
Proc. Am. Soc. Mic., III, 51-60, 1 Pl.
83. Microscopic Forms Observed in Water of Lake Erie.  
Proc. Am. Soc. Mic., IV, 187-196, 1 Pl.
86. Remarks on *Stephanodiscus niagarae*.  
Proc. Am. Soc. Mic., VII, 139-141.
88. Note on a New Rotifer, *Gomphogaster areolatus*.  
Proc. Am. Soc. Mic., IX, 250-252, 1 Pl.
91. A New Daphnella.  
Proc. Am. Soc. Mic., XII, 172-173.
- 91a. Additional Notes on *Gomphogaster*.  
Proc. Am. Soc. Mic., XII, 174-177.

## WARD, H. B.

94. On the Parasites of the Lake Fish.  
Proc. Am. Mic. Soc., XV, 173-182, 1 Pl.
96. The Food Supply of the Great Lakes; and Some Experiments on its Amount and Distribution.  
Trans. Am. Mic. Soc., XVII, 242-254, 2 Pls.
- 96a. A New Method for the Quantitative Determination of Plankton Hauls.  
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99. Fresh-Water Investigations During the Last Five Years.  
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## WOLCOTT, R. H.

99. On the North American Species of the Genus *Atax* (Fabr.) Bruz.  
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84. Note on the Desmidiæ of the United States.  
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